



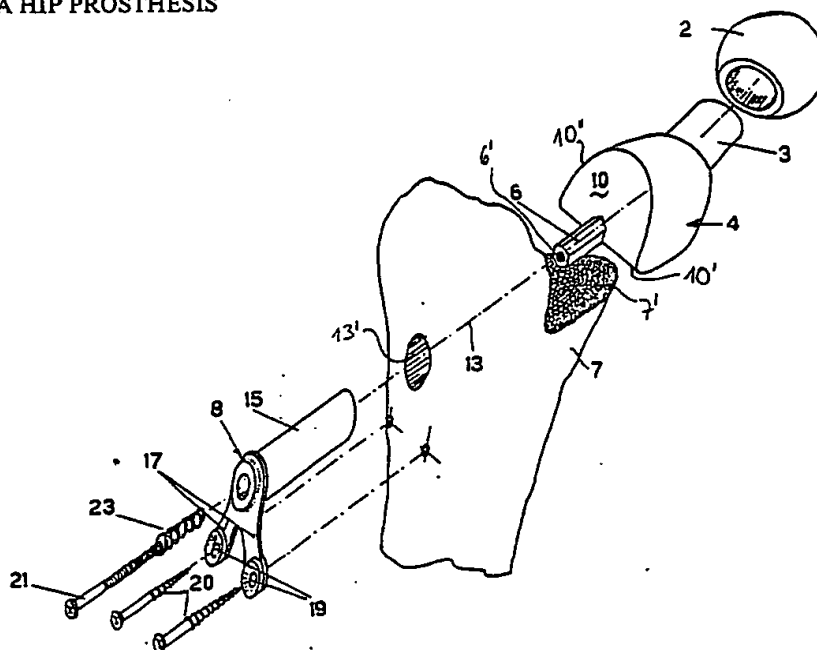
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁴ : A61F 2/36</p>	<p>A1</p>	<p>(11) International Publication Number: WO 86/ 03962</p> <p>(43) International Publication Date: 17 July 1986 (17.07.86)</p>		
<table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>(21) International Application Number: PCT/EP86/00006</p> <p>(22) International Filing Date: 9 January 1986 (09.01.86)</p> <p>(31) Priority Application Number: 85727</p> <p>(32) Priority Date: 11 January 1985 (11.01.85)</p> <p>(33) Priority Country: LU</p> <p>(71) Applicant (for all designated States except US): HOWMEDICA (UK) LIMITED [GB/GB]; 622, Western Avenue, Park Royal, London W3 0TF (GB).</p> </td> <td style="width: 50%; vertical-align: top;"> <p>(74) Agent: GRAALFS, Edo; Neuer Wall 41, D-2000 Ham- burg 36 (DE).</p> <p>(81) Designated States: BE (European patent), CH (Euro- pean patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, NL (European patent), SE (European patent), US.</p> <p>Published With international search report.</p> </td> </tr> </table>			<p>(21) International Application Number: PCT/EP86/00006</p> <p>(22) International Filing Date: 9 January 1986 (09.01.86)</p> <p>(31) Priority Application Number: 85727</p> <p>(32) Priority Date: 11 January 1985 (11.01.85)</p> <p>(33) Priority Country: LU</p> <p>(71) Applicant (for all designated States except US): HOWMEDICA (UK) LIMITED [GB/GB]; 622, Western Avenue, Park Royal, London W3 0TF (GB).</p>	<p>(74) Agent: GRAALFS, Edo; Neuer Wall 41, D-2000 Ham- burg 36 (DE).</p> <p>(81) Designated States: BE (European patent), CH (Euro- pean patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, NL (European patent), SE (European patent), US.</p> <p>Published With international search report.</p>
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(54) Title: JOINT MEMBER FOR A HIP PROSTHESIS

(57) Abstract

Joint member for a hip prosthesis comprising a joint head, a supporting portion including a supporting surface co-operating with a corresponding supporting surface on the proximal femur and fixation means for securing joint head and supporting means to the femur, characterized in that a shankless and block-like supporting member (4, 41) includes at least a supporting surface (10, 11, 43, 44) disposed adjacent the joint head (2, 40) such that the corresponding femur supporting surface (7'', 7') is adjacent the proximal medical femoral cortex, in that further retaining means (15, 21) are provided coacting with the proximal femur (7) and engaging the supporting member (4) through a bore (13') in the femur supporting surface (7'') in order to exert a tensile force on the supporting member (4) laterally to press the supporting surface (10, 11) against the femur supporting surface (7'', 7'), and in that means are associated with the supporting member (4) and/or with the retaining means to prevent a rotation of the supporting member (4) approximately about the axis of the femur neck.



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1 Joint Member For A Hip Prosthesis

 In femoral joint members of conventional hip prostheses
 the joint head is connected via a joint neck to a shank
5 adapted to be introduced in the medullary canal of the femur. The
 elongated shank which is wedge-like in the
 lateral-medial plane is either secured in the femur by
 a jamming effect and/or by means of bone cement. In both
 cases the medullary canal has to be prepared by a drilling
10 operation in order to allow the insertion of the shank.
 A flange-like collar between the prosthesis neck and the
 shank engages a corresponding surface of the proximal
 femur and serves for the support of the prosthesis. The
 force transfer from the joint head of the prosthesis to
15 the femur substantially takes place through the
 prosthesis shank.

 Follow-up studies brought about that after a period of
 ten years after the implantation the loosening rate
20 reaches 35% of the patients operated. Patients operated
 on before the age of 30 years sustain a loosening of up
 to 57% within the five years following the implantation.
 Loosened prostheses cause pain and require hazardous
 reoperations.

25 The main reason for the loosening of the prostheses is
 seen in the different modulus of elasticity of the bone
 material and the prosthesis shank, respectively. Due to
 oscillating loads so-called micro movements occur in the
30 prosthesis shaft leading to a micro-fatigue fracture at
 the interface of both materials.

 The stress pattern of the normal femur changes by the
 implantation of a prosthesis. Portions of the femur normally
35

- 1 allowing extreme loads are not loaded in the same
amount after a prosthesis has been implanted. Con-
sequently a remodeling of the bone structure happens
which also contributes to a loosening of the prosthesis.
5 Additionally, the drilling operation for the insertion
of the shank considerably weakens the portions above the
proximal medial femoral cortex which normally has a
high load capacity.
- 10 Attempts have been made to obviate the mentioned
problems by allowing an ingrowth of bone material in
corresponding parts of the prosthesis. For this purpose
the surface of the prosthesis is provided with irregu-
larities, openings or the like or by developing a bone
15 cement such that it allows an ingrowth of the bone
material. These attempts are not completely satis-
factory.
- 20 The invention is based on the problem to provide a
hip prosthesis which allows an appropriate intro-
duction of force into the femur and which does not
lead to a loosening after a long period of time and
which does not lead to undesired deformation of the femur.
- 25 The joint member according to the invention includes
a block-type supporting member. A prosthesis shank as
usual with conventional femoral prostheses is not
provided. The block-type shankless supporting member
includes at least one supporting surface which is
30 located adjacent to or a small distance from the joint
head such that the corresponding femur supporting
surface is positioned adjacent the proximal medial
femoral cortex. By means of suitable retaining
means which coact with the supporting member through
35 a bore in the femur-supporting surface the supporting

1 member is fixedly drawn or pressed against the femur-
supporting surface. The retaining means is not pro-
vided for bearing the load to which the joint head is
5 the support member fixedly against the supporting surface
of the femur. The transfer of force from the joint head
to the femur is intended to take place immediately
through the supporting surface(s). Suitable means on the
supporting member or on the retaining means prevent a
10 rotation of the supporting member approximately about
the axis of the femur neck. Above all, after the
~~operation, when the supporting member and the femur~~
are not grown together there is a danger that the
supporting member rotates or tilts. Retaining means
15 and antirotation means prevent a tilting and rotating
without substantially contributing to the introduction
of force into the femur.

The retaining or fastening means thus, above all, serves
20 for the primary supply after the replacement of the
hip joint. After supporting member and femur have grown
together the retaining means can be removed if desired.

An antirotational effect for the supporting member can
25 be achieved in that the supporting member and the re-
taining means are provided with co-operating surfaces
which prevent rotation of the supporting member.
Additionally or alternatively the supporting surface
on the supporting member can be oriented such that a
30 torsion or rotational force on the supporting member
about approximately the axis of the femur neck results
in a component normal to the femur supporting surface.
With such a supporting surface on the supporting member
a rotational force thereon would lead to a spreading of
35 the supporting surfaces of the supporting member and

1 the femur. This would cause considerable forces which
are effective as counter-forces relative to the rotational forces
possibly effective on the supporting member.

5 It is preferred to have first and second supporting
surfaces on the supporting member which include an angle
between each other, preferably a right angle. One
supporting surface extends approximately perpendicularly
10 to the femur axis while the other extends approximately in
parallel to the femur axis. During the operation a
corresponding V-shaped cut is made in the proximal femur.

The complementarily formed supporting member is positively
inserted in the cut. The supporting surface extending
substantially parallel to the femur axis preferably has
15 a length in this direction which is of 2/3 of the length
of the extension of the supporting surface
transverse to the femur axis. It is not necessary that
the mentioned supporting surfaces are plane, rather,
they could be composed of subsurfaces which include
20 angles between them. Further, the supporting surfaces
can be provided with elevations, indentations, recesses
or the like for the ingrowth of bone material. It is par-
ticularly preferred if the supporting surface is defined
by the end faces of a plurality of spaced webs, ribs or
25 the like. Such ribs or webs are preferably formed in the
portion of the supporting surface from which the force
is transferred approximately in the axial direction to
the femur. Such supporting webs or supporting ribs have
two main functions. One relies on the fact that during
30 the healing process a sufficient amount of bone substance
can grow between the webs in order to achieve an intimate
connection of the support member with the femur in order
to allow the transfer of all forces from the joint head
to the femur. The second function is defined by a cer-
35 tain resiliency of the webs. Thus, no rigid prosthesis

1 portion borders any much more resilient bone portions.
Rather, in this region an adaptation of the resiliencies
can be achieved so that the above mentioned fatigue
phenomena will not occur. The webs, ribs or the like can
5 be provided with toothings, grooves, holes or the like
in order to facilitate the ingrowth of the bone material.

In one embodiment of the invention an extension is pro-
vided below the supporting surface of the supporting
10 member, the extension coacting with the retaining means.
The extension may include an angle of 30 to 45° to one
~~of the supporting surfaces which include a right angle~~
therebetween. The extension is engaged by the retaining
means in order to press the supporting member laterally
15 as described above. The extension is inserted in the
femur and can be provided with further means to
facilitate an ingrowth of bone material and to achieve
an anti-rotational effect. For this purpose a plurality
of circumferentially spaced wings or fins can be formed
20 at the extension, the radial ends of the wings being
disposed radially inwardly of the associated edge of the
supporting surface.

Different suitable retaining means can be used in order
25 to secure the prosthesis according to the invention to
the proximal femur. A preferred embodiment provides
tensional anchoring means engaging the supporting
member, an opposite surface of the anchoring means co-
operating with the lateral surface of the proximal
30 femur. The tensional anchoring means may include a
screw bolt which can be threaded into a threaded bore
of the supporting member and which is slidably guided
in a sleeve, a compression spring being located between
the head of the screw bolt and the sleeve. Such an
35 arrangement resembles the so-called "Pohl'sche Lasche"

6.

1 which enables an osteosynthesis of femur neck fractures.
By the way it is known to secure a prosthesis head to
the femur by such tensional anchoring means. In the
known prosthesis a flange is provided at one end of
5 the prosthesis neck which is seating against a
respective supporting surface of the femur. In such a
prosthesis the main forces are introduced into the femur
through the anchoring means. Such force transfer is
leading to high surface pressures which also could
10 result in a loosening of the prosthesis. Furthermore, the
known prostheses have no means for preventing a
rotation of the prosthesis head which may also lead
to a loosening. In the invention the tensional anchoring
means essentially serves only for a pressing of the supporting
15 member against the femur and do not - or only to a minor extent -
contribute to an introduction of force into the femur.

A further anti-rotational effect can be achieved by
the mentioned extension being provided with
20 a section having a polygonal cross section, the
polygonal section being adapted to be inserted in
a complementary socket section of the sleeve of the
anchoring means. In this case means have to be
provided preventing a rotation of the sleeve.

25

It is preferred to form the prosthesis of the in-
vention of pure titanium which is particularly bio-
logically compatible to the human body.

30 The invention will be explained hereinafter by way
of some drawings.

35

- 1 Fig. 1 is a schematic perspective exploded view
 of a first embodiment of the invention
- Fig. 2 shows a section through the prosthesis
5 according to Fig. 1 in its implanted
 state.
- Fig. 3 is an exploded view showing the preparation
 of the femur in order implant the prosthesis
10 according to the invention.
-
- ~~Fig. 4 is a side view of another embodiment of the~~
 ~~invention.~~
- 15 Fig. 5 shows a top plan view of the prosthesis
 according to Fig. 4.
- Fig. 6 is a posterior view of the prosthesis
 according to Fig. 4.
- 20
- Before going into detail it should be mentioned that
 each feature to be described may be a part of the
 invention per se or in connection with the features
 of the claims.
- 25
- Figs. 1 to 3 show the proximal portion 7 of a femur
 which has been provided with a rectangular cut in a
 manner as to be described later. By the cut a
 supporting surface 7' is formed extending sub-
30 stantially rectangularly to the femur axis. A further
 vertical supporting surface 7'' is formed extending
 approximately parallel to the femur axis. The femur
 7 is provided with a throughbore 13' along an axis
 13 extending at a small acute angle to the natural
35 femur neck axis.

1 The femoral prosthesis illustrated in Figs. 1 and 2
comprise a block-like supporting member 4 including
a medially extending conical plug 3 which co-operates
with the conical bore in a joint ball 2. The support-
5 ting member 4 includes two supporting surfaces 10, 11
including a right angle therebetween, the intersection
line of the supporting surfaces 10, 11 being rounded
as shown at 10'. Near the rounded edge 10' an extension
6 extends from the supporting surface 10 along the
10 axis 13, the extension 6 having a hexagonal cross
section. The extension 6 includes a threaded axial bore
6'. The supporting surfaces 10 and 11 are defined by the
rounded edge 10' and an arcuate edge 10''. This can
be seen in Fig. 2 relative to the supporting surface
15 10. The supporting surface 11 is formed correspondingly.
The supporting member 4 has a rounded external con-
tour between the supporting surfaces 10, 11.

As can be seen in Fig. 2, the supporting member 4 is
20 matched to the cut of femur 7 said cut being defined
by the supporting surfaces 7', 7''. As can be seen
in Fig. 2 further the length of the supporting surface
10 if viewed in axial direction is $\frac{2}{3}$ of the length
of the supporting surface 11 if viewed transverse to
25 the femur axis. If the supporting member 4 is inserted
in the mentioned cut, the extension 6 is introduced
into the bore 13'. A sleeve 15 is introduced into the bore
13' laterally, the sleeve including a socket portion
15' at its interior end portion, the socket portion
30 having a hexagonal cross section. The cross section
of the socket portion 15' is such that the extension
6 is matching the socket portion 15'. A screw bolt 21
is introduced in the sleeve 15, the screw bolt 21
being threaded in the threaded bore of the extension
35 6. A spring 23 is located in an enlargement 25 of the

1 sleeve bore, one end of the spring 23 is seated against
the shoulder of the enlargement, the other end of the
spring seating against the lower side of the bolt
5 by the sleeve the supporting member 4 can move away
from the supporting surfaces 7', 7" a small amount if engaged
by the respective forces. A flange 8 is formed on the
lateral side of the sleeve 15, the flange engaging
the lateral side of the femur 7. Plate-like extensions
10 17 are integrally formed with the flange, the extensions
17 being disposed in a bifurcate arrangement and including holes 19
at the ends thereof which receive bone screws 20. The relay, the
extension 17 can be fixedly secured to the femur 7 by the bone
screws and thus prevent rotation of the sleeve 15.

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As can be particularly seen in Fig. 2 the introduction of
force from the prosthesis head into the femur 7 takes
place essentially through the supporting surfaces 10,
11 and the supporting surfaces 7, 7'', respectively.
20 The femur supporting surface 7' substantially receives
the compression forces in the region of the proximal
medial femoral cortex, while the femur support-
ing surface 7'' substantially receives the smaller
tensional forces. A portion of the tensional forces
25 is also received by the extension 6 and the anchoring
means as shown. The anchoring means as shown by which
the supporting member 4 is pressed against the support-
ing surfaces 7', 7'' of the femur is important above
all for a primary supply before the supporting
30 member and the femur are grown together. To enhance
this effect, the supporting member can be provided with
holes, elevations, toothings, indentations or the like.
The engagement of the extension 6 with the sleeve 15
contributes to the rotational stability of the support-
35 ing member 4 together with the specific orientation of the

1 supporting surfaces 10, 11.

As can be seen, supporting member 4, extension 6 and tap 3 are integrally formed, e.g. by casting. Preferably pure titanium is used.

5

The prosthesis member shown in the Figures 4 to 6 comprises a joint ball 40, a supporting member 41 and a hexagonal extension 42. The hexagonal extension 42 is integrally formed with the supporting member 41 and resembles the extension 6 of the embodiment described above. The supporting member 41 includes a supporting surface 43 substantially parallel to the femur axis. A further supporting surface 44 extending perpendicularly to the supporting surface 43 is defined by the plane end surfaces of webs 45 which extend downwards from the solid portion of the supporting member 41 substantially normal to the common plane of the end faces. The external edges of the webs 45 are arranged on an arc (see Fig. 4 in connection with Fig. 6). The axis of the webs parallel to the common plane extends radially to the arc so that the distances between the webs radially inwards are smaller than radially outwards. The surfaces of the webs facing each other are provided with a toothing or with grooves which is not illustrated. The webs further can be provided with holes or the like which is also not shown. As can be seen in Fig. 6 the contour of the supporting surface 43 resembles the contour of the supporting surface 10 of the supporting member 4 according to Figs. 1 and 2. Wings 46 or fins extend from the supporting surface 43, the wings 46 being radially formed at the extension 42. In this embodiment as shown six wings 46 are equally circumferentially spaced. The wings 46 also can be provided with holes, recesses, toothings or the like also at their end faces. Upon implantation the wings are introduced in a corresponding bore in the femur along the axis 13 of Fig. 1.

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- 1 The implantation of the prosthesis shown in Figs. 4 to
6 is similar to that of the prosthesis according to
Figs. 1 and 2. The main difference between the embodi-
ments shown is that in the case of the supporting
5 member 41 the support on the femur supporting surface
7' occurs through "legs" and not through a continuous
plane supporting surface 11 according to Fig. 2. The
spaces between the webs 45 or the legs enable an
ingrowth of bone material during the healing process.
10 The webs 45 further show a larger resiliency than a
rigid supporting body. Bone material can also grow
~~between the wings 46 and improve the secure fixation~~
and the rotational stability of the prosthesis as shown.
The prosthesis as shown according to Figs. 4 to 6 enables
15 also an intimate ingrowth of the femur bone such that
the retaining means as shown in Fig. 2 will be only
necessary for the first healing phase, afterwards the
retaining means could be removed if desired.
- 20 The prosthesis shown in Figs. 4 to 6 is also made preferably of
titanium. The surfaces of the prosthesis contacting
the bone can be coated with a material which improves
the mechanical stability and enhances the ingrowth
of bone material. Such a material is for instance tri-
25 calcium phosphate ceramic. The porous ceramic has a
porosity of for instance 200 to 500 microns. The
mentioned ceramic is resorbable, the resorbed
ceramic will be slowly displaced by the bone substance.
- 30 In Fig. 3 tools are shown which serve for the im-
plantation of the prosthesis according to Figs. 1
and 2 or 4 to 6. In Fig. 3 an Y-like saw guide 71 is
shown, the shaft 77 thereof includes a longitudinal
slot for a screw 80 for an attachment to a bore gauge
35 for bone screws 85 corresponding to bone screws 20 of

1 Fig. 1, and for a screw bolt 81 corresponding to the
screw bolt 21 which co-operates with a spring 43
corresponding to spring 23 of Fig. 1. In the arms of
the guide 71 slots are provided forming a right angle.
5 At the intersection of the arms a bore 82 is formed.
By means of the slots in the arms 29 the supporting
surfaces 7', 7'' are cut in the femur 7. The radius
at the intersection line of the supporting surfaces
is made by a drilling tool introduced through the
10 bore 82. Thereafter a template 75 for the throughbore
76 is placed in the cut thus formed, the lateral recess
thereof co-operating with the shaft of the screw 89
placed in the recess 90 through the bore 82. In this
way the bore 13' in femur 7 (see Fig. 1) is formed.

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1 PATENT CLAIMS

1. Joint member for a hip prosthesis comprising a joint head, a supporting portion including a supporting surface co-operating with a corresponding supporting surface on the proximal femur and fixation means for securing joint head and supporting means to the femur, characterized in that a shankless and block-like supporting member (4, 41) includes at least a supporting surface (10, 11, 43, 44) disposed adjacent the joint head (2, 40) such that the corresponding femur supporting surface (7'', 7') is adjacent the proximal medical femoral cortex, in that further retaining means (15, 21) are provided coacting with the proximal femur (7) and engaging the supporting member (4) through a bore (13') in the femur supporting surface (7'') in order to exert a tensile force on the supporting member (4) laterally to press the supporting surface (10, 11) against the femur supporting surface (7'', 7'), and in that means are associated with the supporting member (4) and/or with the retaining means to prevent a rotation of the supporting member (4) approximately about the axis of the femur neck.
2. The joint member according to claim 1, characterized in that on the side of the supporting member (4) opposite to the joint head (2) and on the retaining means co-operating surfaces (6, 15') are formed which prevent a rotation of the supporting member (4).
3. The joint member according to claim 1 or 2, characterized in that the supporting surface (10, 11) of

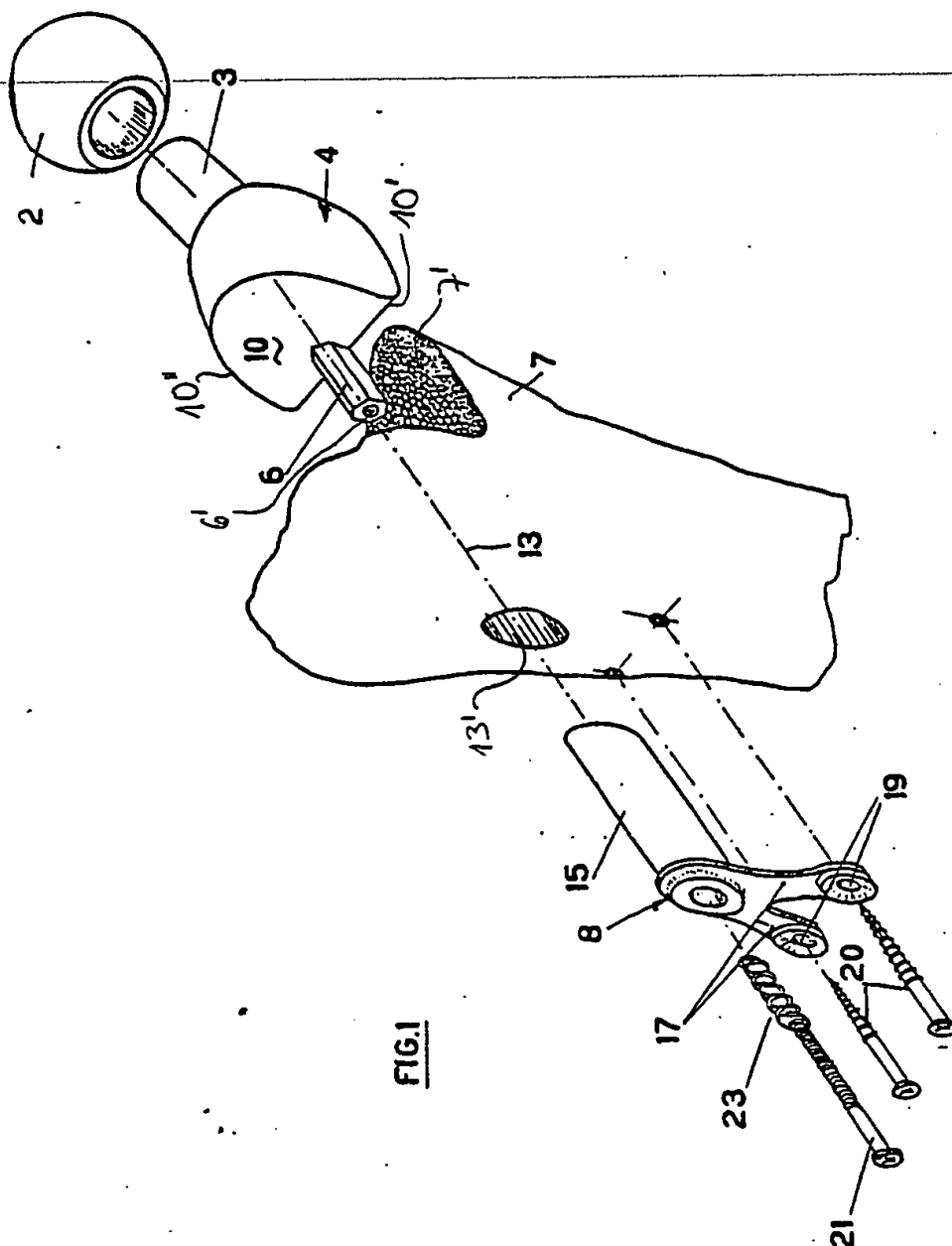
- 1 the supporting member (4) is oriented such that a
rotational force approximately about the axis of the
femur neck exerted on the supporting member results in
a force component normal to the femur supporting
5 surface (7').
4. The joint member according to one of the claims 1 to
3, characterized in that at least a first supporting
surface (11) extends approximately rectangularly to
the femur axis and in that at least a second support-
10 ing surface (10) includes an angle to the first
supporting surface (11) and extends towards the
proximal end of the femur 7.
-
5. The joint member according to claim 4, characterized
in that the first and the second supporting surface
15 (10, 11) intersect each other under an angle of pre-
ferably 90°.
6. The joint member according to claim 4 or 5, charac-
terized in that the first and/or the second support-
ing surface are subdivided in subsurfaces which
20 extend at an angle relative to each other.
7. The joint member according to one of the claims 1 to
6, characterized in that the supporting surface in-
cludes elevations, indentations, recesses or the like
allowing ingrowth of bone material.
- 25 8. The joint member according to claim 7, characterized
in that the supporting surface (44) is defined by the
end surfaces of a plurality of webs (45), ribs or the
like.
- 30 9. The joint member according to one of the claims 1 to
8, characterized in that the contour of the outer
edge of the supporting surface(s) (10, 11, 43, 44) is
arcuately shaped and/or the external surface of the
supporting member (4, 41) is rounded.
- 35

- 1 10. The joint member according to claim 8 or 9, characterized in that the webs (45), ribs or the like are arranged radially relative to the arcuate outer edge.
- 5 11. The joint member according to one of the claims 1 to 10, characterized in that below the supporting surface (10, 11) an extension (6, 42) is provided co-operating with the retaining means.
- 10 12. The joint member according to claim 11, characterized in that a plurality of radial wings (46) or fins are formed, the radial outer ends thereof are located radially inwardly of the associated edge of the supporting surface (44).
- 15 13. The joint member according to claim 8 or 12, characterized in that the surfaces of the webs (45), ribs or the like facing each other and/or the surfaces of the radial wings or fins (46) include holes, grooves, toothings or the like irregularities.
- 20 14. The joint member according to claim 12 and 11, characterized in that a section of polygonal cross section is formed on the extension (6, 42), the polygonal section being adapted to be inserted into a complementary socket (15') of the retaining means (15, 21).
- 25 15. The joint member according to claim 1, characterized in that the retaining means include anchoring means engaging the supporting member (4), the anchoring means including a counter-surface co-operating with the lateral surface of the proximal femur (7).
- 30 35

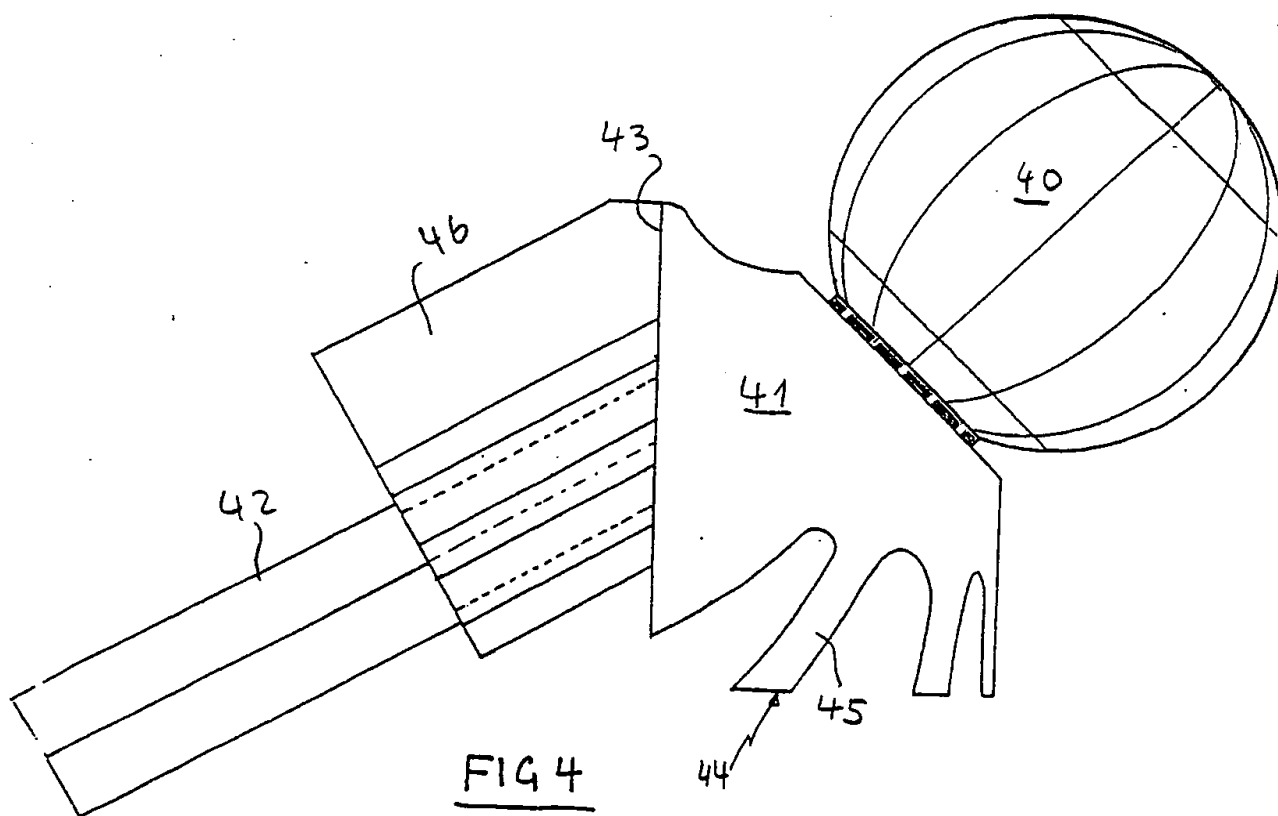
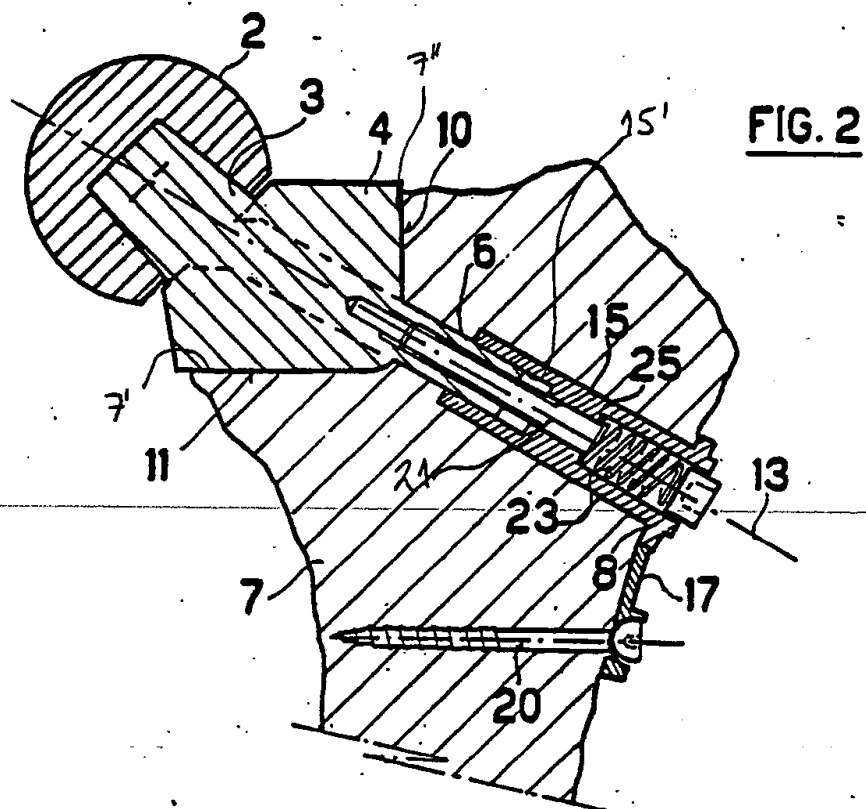
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- 1 16. The joint member according to claim 15, characterized
in that the anchoring means include a screw bolt
(21) which is adapted to be threaded in a threaded
axial bore (6') of the extension (6), the screw bolt being
5 slidably guided in a sleeve (15), a compression
spring (23) being located between the head of the
screw bolt (21) and the sleeve (15).
- 10 17. The joint member according to claim 14 and 16,
characterized in that the polygonal section of the
extension (6) is adapted to be inserted in a com-
plementary socket portion of the sleeve (15), the
sleeve (15) including means which prevent a rotation
of the sleeve (15) about the sleeve axis.
- 15 18. The joint member according to claim 17, characterized
in that plate means (17) are affixed to the sleeve,
the plate means being adapted to be positioned
against the femur, the plate means (17) including
20 at least one hole for a bone screw (20).
- 25 19. The joint member according to claim 1, characterized
in that the supporting surface(s) is(are) coated with a
material which is at least partially resorbable,
for instance by tri-calcium phosphate ceramic.
- 30 20. The joint member according to claim 19, characterized
in that the pores of the ceramic have a diameter of
about 200 to 500 micron.
- 35 21. The joint member according to claim 1, characterized
in that the supporting member (4, 41) is made of
pure titanium (99,99%).

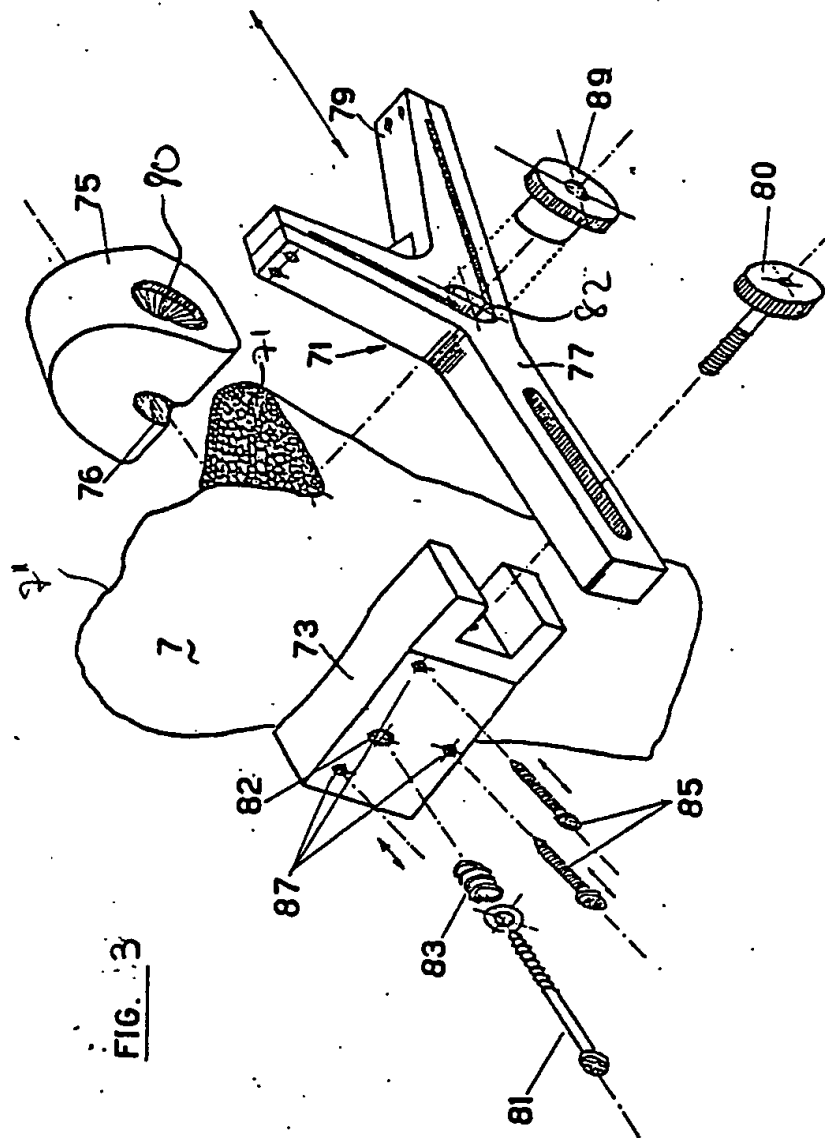
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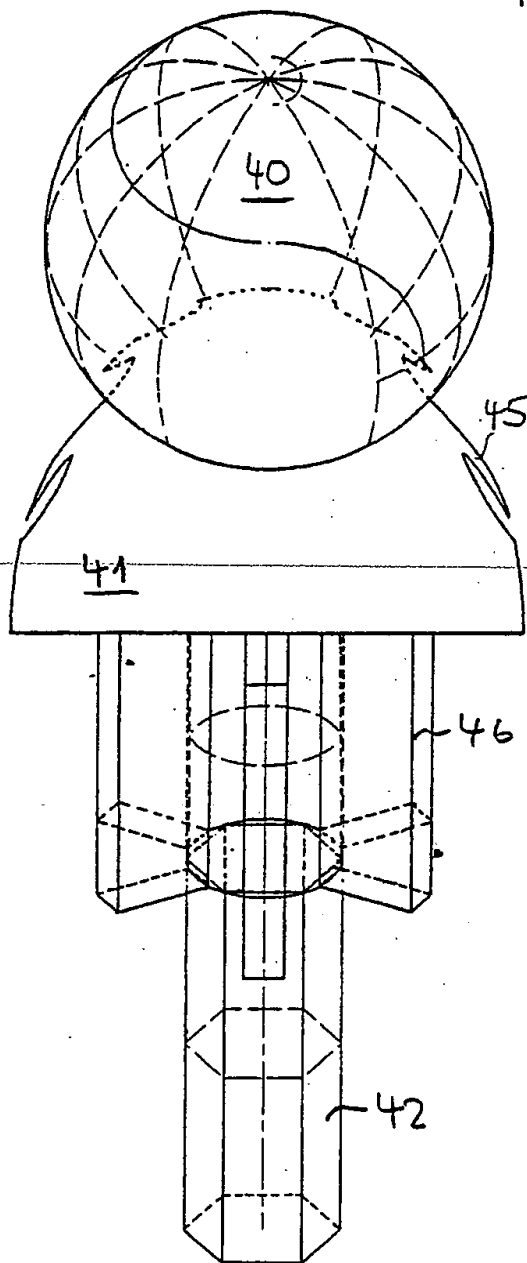


FIG 5

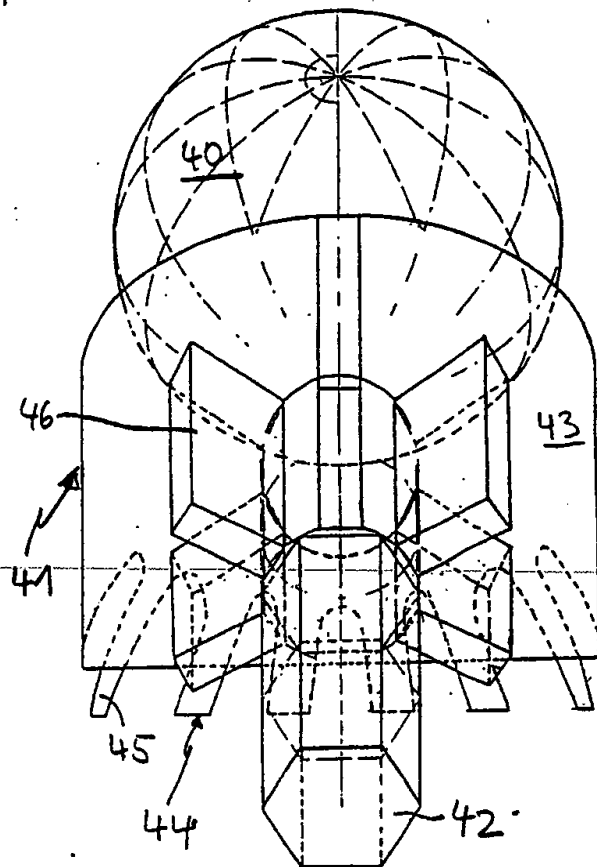


FIG 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 86/00006

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁴ : A 61 F 2/36																				
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">IPC⁴</td> <td style="vertical-align: top; padding: 5px;">A 61 F A 61 B</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	IPC ⁴	A 61 F A 61 B														
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category ¹⁰</th> <th style="width: 70%; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">EP, A, 0099167 (YAPP) 25 January 1984, see page 4, lines 11-17; figures --</td> <td style="vertical-align: top; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">FR, A, 2528307 (DUPUIS) 16 December 1983, see page 2, lines 4-9, 31-33; figures --</td> <td style="vertical-align: top; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">FR, A, 1046516 (CHEVALIER ET FILS) 8 July 1953, see page 2, left-hand column, lines 1-22; figure 8 --</td> <td style="vertical-align: top; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">GB, A, 2033755 (RAMBERT et al.) 12 October 1979, see page 2, lines 40-47; figure --</td> <td style="vertical-align: top; text-align: center; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">US, A, 4163292 (AVERETT, Jr.) 7 August 1979, see column 2, lines 25-29; figures ----</td> <td style="vertical-align: top; text-align: center; padding: 5px;">1</td> </tr> </table>			Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	EP, A, 0099167 (YAPP) 25 January 1984, see page 4, lines 11-17; figures --	1	A	FR, A, 2528307 (DUPUIS) 16 December 1983, see page 2, lines 4-9, 31-33; figures --	1	A	FR, A, 1046516 (CHEVALIER ET FILS) 8 July 1953, see page 2, left-hand column, lines 1-22; figure 8 --	1	A	GB, A, 2033755 (RAMBERT et al.) 12 October 1979, see page 2, lines 40-47; figure --	1	A	US, A, 4163292 (AVERETT, Jr.) 7 August 1979, see column 2, lines 25-29; figures ----	1
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																				
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search <div style="text-align: center;">11th April 1986</div></td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report <div style="text-align: center;">29 APR 1986</div></td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority <div style="text-align: center;">EUROPEAN PATENT OFFICE</div></td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer M. VAN MOL </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center;">11th April 1986</div>	Date of Mailing of this International Search Report <div style="text-align: center;">29 APR 1986</div>	International Searching Authority <div style="text-align: center;">EUROPEAN PATENT OFFICE</div>	Signature of Authorized Officer M. VAN MOL														
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/EP 86/00006 (SA 11844)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 21/04/86

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0099167	25/01/84	JP-A- 58209348 AU-A- 1347483	06/12/83 17/11/83
FR-A- 2528307	16/12/83	None	
FR-A- 1046516		None	
GB-A- 2033755	29/05/80	FR-A,B 2438470	09/05/80
US-A- 4163292	07/08/79	None	

For more details about this annex :
see Official Journal of the European Patent Office, No. 12/82

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